Quarknet Center Report for 2011-2012

University of Houston and Rice University

During the academic year 2011-2012 our QuarkNet center sponsored three "Saturday Physics" events. On October 11, 2011, Professor Ed Hungerford of UH presented "The Standard Model" to a standing-room only audience of over 200 students and 7 teachers on the UH campus. On January 21, 2012, Professor Kwong Lau of UH presented ""Rags to Riches; The Story of the Neutrino" to more than 175 attendees on the UH campus. On February 25, 2012, Professor Paul Chu of UH presented "Superconductivity; 25 Years of Progress and More" to more than 175 students and to 13 teachers on the UH campus.

On March 24, 2012, we participated in the CMS Master Class. This event was held on the University of Houston campus, and we had over 30 students and 2 teachers taking part. Professor Pinsky from UH gave an introductory talk with a great deal of interaction and questions. Then Professor Corcoran of Rice discussed detectors and introduced the exercise that the students would do. We gave the students very specific instructions, and they split into groups with each group analyzing a different data set from the Master Class web site. This year the students were looking at CMS data that contained W and Z candidates. They were asked to indicate if an event was more likely to be a W or Z, based on the missing energy. They were also asked to identify the leptons as either electrons or muons. For dimuon or di-electron events, a spreadsheet calculated the invariant mass of the lepton pair. We did get a reasonable Z peak, but we felt that this exercise we too complicated for the students to really appreciate. The students had fun and learned a lot, but we thought they did not come away with a good understanding of what the exercise was about. Looking back over several master classes, the best exercise (our opinion) was the $Z \rightarrow \mu\mu$, $Z \rightarrow ee$, $Z \rightarrow$hadrons, and $Z \rightarrow \tau\tau$ relative branching ratios from LEP data.

Our site provided Summer Research Fellowships to eight students (Shirley Zhang, Alex Mo, Milan Das, and Willis Nguy of Bellaire High School; Shawn Cooper and Hilda Sebesta of Wunsche High School; Hannah Klein of Woodlands College Park High School; Kevin Moore of Dulles High School) and one teacher (Travis Brown of Clear Creek High School) for six weeks starting June 11. Shawn and Kevin worked with professor Don Kouri to learn an Introduction to Quantum Mechanical Research. Shirley and Travis worked with Professor W.K Chu to determine the yield of Silver Sputtering by Argon Cluster ion beams. Hannah and Milan worked with professor Jim Meen to prepare “high temperature” superconconducting materials and to analyze them by SEM and X-Ray diffraction. Hilda worked with professor Mini Das to use MATLAB in Imaging Physics. Alex worked with professor Gemunu Gunaratne to construct and analyze electrical networks that can mimic gene systems and even ecosystems and gravitational systems. Willis worked with professor Freundlich on solar cell developments. The fellows were also treated to three luncheon seminars by professors, Freundlich, Kouri, and Meen.

During the week of June 11 we held a workshop for high school teachers on the Rice campus. We had 23 teachers in attendance, several of them first time Quarknet attendees. Our emphasis this year (same as last year) was on the cosmic ray detectors. We had two new detectors that some of the teachers assembled. We had two other detectors that the teachers worked with and successfully plateaued. We also had several talks including an introduction to the Standard Model by Ed Hungerford from University of Houston. We had a talk from former Rice graduate student Dennis Mackin about proton beams for cancer therapy. Dennis also arranged a tour of Houston’s proton therapy facility for some of the teachers. We also had a talk about the physics of music by Frank Tofelleto, who gave such a course this past semester. One morning our lead teacher Nancy Cashiola led the other teachers through an exercise to calculate the top quark mass from D0 data. On Friday morning the teachers shared teaching techniques and tips in a very lively discussion which included musical performances by some of the teachers!

Each afternoon during our workshop we worked on the cosmic ray detectors. The teachers split into groups, with two of the groups constructing the new detectors. These groups succeeded in building and plateauing both new detectors. We also had two old detectors which had been assigned to teacher s in the Houston area in previous years. These detectors gave the teachers experience in plateauing and working with the detectors. In one case we tracked down light leaks and re-wrapped some of the scintillator. This was a very successful and fun workshop.

Submitted by

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